FACILITY DESCRIPTIONS AND UPDATED COST ESTIMATES FOR THE MULTIPLE INTAKES OPTION

Prepared by the CALFED Storage and Conveyance Refinement Team

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The *Facility Descriptions and Updated Cost Estimates for the Multiple Intakes Option* has been prepared as part of the Storage and Conveyance Component Refinement Task of the CALFED Bay-Delta Program (CALFED or Program). CALFED's mission is to develop a long-term comprehensive plan that will restore the ecological health and improve water management for beneficial uses of the San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) system.

This report summarizes the principal features, estimated costs, and environmental considerations of constructing a Multiple Intakes Option project which would consist of three separate diversion and conveyance facilities from the Bay-Delta to Clifton Court Forebay. The Multiple Intakes Option would provide an alternative means of diverting water from the Sacramento-San Joaquin Delta (Delta) for export to the San Joaquin Valley and Southern California. The general location of this project is shown on Figure 1.

This evaluation and others being performed by CALFED are intended to provide facilities evaluations and updated costs estimates of representative storage and conveyance components. The objectives of the Multiple Intakes Option evaluation are (1) to provide an estimate of the capital cost of constructing this project within the range expected if the project were to be constructed today and (2) to enable CALFED to compare this project against other projects that might be considered as part of a long-term CALFED solution strategy.

The Multiple Intakes Option is a new diversion and conveyance option developed by CALFED and, therefore, limited existing information is available on this project. The estimated capital cost for constructing the Multiple Intakes Option was developed primarily by Bookman-Edmonston Engineering and was based on available information, previous experience, and engineering judgment. The previous studies used to aid the predevelopment of the present cost estimate include the 1993 Department of Water Resources (DWR) *Interim South Delta Program*

(ISDP) Cost Estimate, Proposed Clifton Court Forebay Northern Intake Structure and the 1995 DWR report *Isolated Transfer Facility Cost Estimate.*

A preliminary evaluation of the environmental considerations associated with this project has also been included in this report. Fish, wildlife, plant, and cultural resources that could be affected have been described and potential impacts have been identified. The information for the evaluation of environmental considerations was gathered from existing literature.

PROJECT BACKGROUND

Reclamation of Delta marshlands began in the 1850s, and by the 1930s, nearly all of the Delta had been reclaimed into intensely farmed islands. Ocean salinity intrusion to the interior of the Delta was observed as early as the 1840s and was recognized as a potential problem to water supplies. Since that time, there have been numerous studies of methods to control salinity intrusion and otherwise improve the management of the water resources in the Delta.

The Multiple Intakes Option is a relatively new water conveyance concept which would help improve the management of water resources in and through the Delta. Over the past several years, studies have been completed for similar concepts which would essentially move the water export point from Clifton Court Forebay to another point within the Delta. However, a review of the DWR and the U.S. Bureau of Reclamation (Reclamation) libraries and publications revealed no previous investigations of the Multiple Intakes Option, which would provide three alternative points of diversions within the Delta to convey water to Clifton Court Forebay for export. Detailed below is a brief summarization of the major events that have led to the Multiple Intakes Option concept.

In 1960, California voters approved the Burns-Porter Act to assist in the financing of the State Water Project (SWP). This Act authorized Delta facilities "... for water conservation, water supply in the Delta, transfer of water across the Delta, flood and salinity control, and related

functions." In the same year, DWR proposed the Delta Water Project to serve as the Delta water facility of the SWP. This plan, however, was met with stiff opposition from Delta water users, boaters, fish and wildlife agencies, and other Delta interests. In 1965, the Interagency Delta Commission (comprised of DWR, California Department of Fish and Game [CDFG], Reclamation, and the U. S. Army Corps of Engineers) recommended the "Peripheral Canal" as an acceptable plan for water transfers across the Delta. The Peripheral Canal would convey water from the Sacramento River at Hood to the State and federal pumping plants in the south Delta while minimizing interference with Delta waterways and releasing freshwater to Delta channels to maintain water quality and mitigate impacts to fish.

While DWR and Reclamation accepted and supported the construction of the Peripheral Canal as a joint-use facility of the SWP and the Central Valley Project (CVP), the facility was never constructed, partly for the following reasons:

- Although Reclamation and the Department of the Interior (Interior) embraced the concept of the facility in 1969, federal funding was never forthcoming.

- There was continuing fear of and controversy over the cost of the facility and of potential harm to the Bay-Delta from improper operation: some water users believed that water could be obtained at a lower cost; other Delta interests feared that guarantees for Delta protection could be changed or ignored during times of shortage.

DWR began reassessing the Peripheral Canal in 1975, resulting in Bulletin 76 (DWR, July 1978), which identified and considered numerous alternative water transfer facilities. In 1980, the State Legislature passed and then Governor Brown signed Senate Bill (SB) 200. This bill authorized the Peripheral Canal and provided specific guarantees to protect the Delta and to meet the water needs of the SWP through the year 2000. SB 200 was subjected to a referendum vote in June 1982, which California voters did not approve.

As part of a continuing effort to better manage the Delta, DWR and Reclamation have conducted several studies over the past decade. In July 1996, DWR and Reclamation jointly released the *Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS)--Interim South Delta Program (ISDP).* The ISDP had two objectives: (1) to improve water levels and circulation in south Delta channels for local agricultural diversions and (2) to improve south Delta hydraulic conditions to increase diversions into Clifton Court Forebay to maximize the frequency of the full pumping capacity of Banks Pumping Plant. Various elements of the ISDP have been incorporated into the following evaluation of a Multiple Intakes Option.

The Multiple Intakes Option concept was identified in a March 1997 CALFED technical studies report entitled *Status Reports on Technical Studies for the Storage and Conveyance Refinement Process.* This Delta conveyance concept has recently gained recognition through the CALFED process as a potential part of a long-term comprehensive plan that could restore the ecological health of and improve water management of the Bay-Delta. This evaluation builds on that concept and will provide CALFED with a cost estimate and a written description of the Multiple Intakes Option project that will enable it to be compared to other projects for consideration as part of a long-term CALFED solution strategy.

FACILITIES DESCRIPTION

This section provides an overview of the major features included in the Multiple Intakes Option. The preliminary layout of the Multiple Intakes Option is based on original work developed by CALFED staff and Bookman-Edmonston Engineering. The Multiple Intakes Option includes three separate intake facilities each with a capacity of 15,000 cubic feet per second (cfs) as well as improvement to CVP and SWP south Delta export facilities. This intake and conveyance system would provide water operation flexibility by allowing diversions to take place at one of the three separate intake locations in the Delta to limit environmental and water quality impacts. The Multiple Intakes Option described in this evaluation is intended to be combined with other Delta improvements to increase the efficiency and capacity of the Delta conveyance system.

PROJECT LOCATION

The general project location of the Multiple Intakes Option is shown in Figure 1. The Multiple Intakes Option would be located in the Delta in San Joaquin and Contra Costa Counties. The proposed facilities would include three new diversion structures and conveyance facilities. These are known as the Northern 15,000 cfs Isolated South Delta Intake (Northern Intake), the Western 15,000 cfs Isolated South Delta Intake (Western Intake), and the Eastern 15,000 cfs Isolated South Delta Intake (Eastern Intake). Figure 2 provides a detailed location map of these three components and the CVP and SWP improvements which make up the Multiple Intakes Option. This map is complete with locations of all the relevant facilities, including gated intake structures, fish screens, pumping plants, isolated conveyance channels, and setback levee channels.

The Northern Intake would begin on the north side of Lower Roberts Island along the San Joaquin River and would divert water into an isolated conveyance channel which would continue south to Highway 4 where it would turn southwest and parallel Highway 4 to Middle River. The channel would continue southwest on Union Island through Coney Island for approximately 14 miles to Clifton Court Forebay.

The Western Intake would begin at the northeast corner of Palm Tract on Rock Slough. Setback levees would create an isolated channel that would convey water south across Palm Tract, Orwood Tract, Byron Tract, and Victoria Island for approximately 8 miles to Clifton Court Forebay.

The Eastern Intake would begin at Upper Roberts Island and divert San Joaquin River water into an isolated channel which would continue west across Upper Roberts Island and Union Island for approximately 14 miles before reaching Clifton Court Forebay.

PROJECT DESCRIPTION

The Multiple Intakes Option concept consists of three separate intake and conveyance facilities hydraulically isolated from existing Delta channels to convey Delta water to Clifton Court Forebay. As proposed, the Multiple Intakes Option would help alleviate fish impacts and water quality concerns for Delta exports by providing three alternatives for conveying water to Clifton Court Forebay. As mentioned earlier, the Multiple Intakes Option would also include CVP, SWP, and other Delta channel improvements to form multiple and flexible conveyance systems to move water through the Delta.

PRINCIPAL FACILITIES

The section provides an overview of the major facilities of the Multiple Intakes Option. This includes the three intake and isolated conveyance facilities as well as proposed CVP and SWP improvements. Generally, the principal facilities for each of the three intakes include a gated intake, an earthlined isolated conveyance channel, under river siphon crossings, and associated works. Table 1 provides a summary of the physical characteristics of each of the major features associated with the Multiple Intakes Option.

Northern Intake

In general, the Northern Intake would include a 14-mile-long earthlined isolated conveyance channel complete with an intake structure, three under river siphon crossings, and associated works. The Northern Intake would require construction of new facilities on three Delta Islands, including Lower Roberts Island, Union Island, and Coney Island. Water would be diverted from the San Joaquin River through a low-lift pumping plant to Lower Roberts Island and conveyed southwest through Union Island and Coney Island to Clifton Court Forebay. A concrete transition would be constructed between the intake structure and the pumping plant. The

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Northern Intake would have a 2,000-foot-wide alignment for its entire length. This alignment would require construction of nine bridges and crossings.

The main conveyance channel would consist of an earthlined, open channel located in the center of the alignment. As shown in Figure 3, the typical cross section of the isolated facility would generally consist of a trapezoidal section with side slopes of 3:1. Back slopes would be 2:1, and special treatment would be required in areas where the peat soil may pose a threat to stability. Located on either side of the channel would be a 20-foot-wide operations and maintenance (O&M) road. The 15,000 cfs channel would have a top width of 350 feet, a bottom width of 140 feet, and a depth of 28 feet from the normal operating water surface elevation. The capacity of channel and all the related facilities would be 15,000 cfs. Detailed below are more complete descriptions of the facilities on each of the islands that comprise the Northern Intake component configuration.

Lower Roberts Island

The reaches of the Northern Intake would consist of a gated intake located on the north side of the Lower Roberts Island on the San Joaquin River. The intake facility would consist of five 20' x 20' Tainter Gates with a capacity of 15,000 cfs. For the Northern Intake, a low-lift pumping plant is required to provide sufficient hydraulic head for gravity flow to Clifton Court Forebay. The 15,000 cfs pumping plant would consist of 11 pumping units, including one standby unit, and would have a total horsepower of 25,080 and a total dynamic head of 10 feet. From the intake and pumping plant, water would enter the earthlined open channel would continue south for about five miles to Highway 4. At this location the channel would continue southwest, parallel to Highway 4, to Middle River where it would be siphoned beneath Middle River to Union Island. This siphon would consist of six 30' x 30' concrete boxes to convey 15,000 cfs 600 feet from Lower Roberts Island to Union Island.

Union Island

Water entering Union Island from Lower Roberts Island would enter the earthlined, open channel and would continue southwest for about 20,000 feet adjacent to the south bank of Victoria Canal/North Canal. At the west end of Union Island, the channel would then be siphoned beneath Old River to Coney Island. This siphon would consist of six 30' x 30' concrete boxes which would convey the 15,000 cfs 700 feet from Union Island to Coney Island.

Coney Island

Water entering Coney Island from Union Island would enter the earthlined open channel and would continue southwest for about 3,500 feet before being siphoned beneath the West Canal into Clifton Court Forebay. This siphon would consist of six 30' x 30' concrete boxes to convey 15,000 cfs 400 feet from Coney Island to Clifton Court Forebay. Also, there would be a control gate in Clifton Court Forebay to regulate the flows from the Northern Intake Facility.

Western Intake

The Western Intake would include an 8-mile-long, isolated setback levee channel with an intake structure, four under-river siphon crossings and associated works to convey 15,000 cfs from the northeast corner of Palm Tract at the confluence of the Old River and Rock Slough to Clifton Court Forebay. Specifically, the Western Intake would require construction of new facilities on four Delta Islands, including Palm Tract, Orwood Tract, Byron Tract, and Victoria Island. The Western Intake conveyance alignment would be approximately 1,000 feet wide and would be separated from the existing Delta channels utilizing a new setback levee and existing levees. The new setback levee would be located about 500 feet to the west of the existing Old River channel levees. Figure 4 shows a typical cross-section of the Western Intake setback levee channel.

Palm Tract

The heading of the Western Intake would consist of a gated intake facility on the northeast corner of Palm Tract at the confluence of Old River and Rock Slough. The intake facility would consist of five 20' x 50' Tainter Gates with a capacity of 15,000 cfs. The water would enter the intake facility and flow by gravity through the isolated setback levee channel, which would be created by constructing a new setback levee 500 feet to the west of Old River. The existing levee protecting Palm Tract would separate Old River from the isolated channel and would become the east bank of the isolated channel. A concrete section would be constructed to provide a transition between the intake facility and the earthlined channel. Depending on the meanders in the Old River adjacent to Palm Tract, the isolated channel would be approximately 500 feet wide. A siphon at the southern end of Palm Tract would cross beneath an unnamed slough, Mokelumne Aqueduct, and railroad tracks to Orwood Tract. The siphon structure would consist of six 30' x 30' concrete boxes to convey 15,000 cfs capacity 13,000 feet from Palm Tract to Orwood Tract.

Orwood Tract

Water siphoned from Palm Tract would enter the setback levee channel and continue south for about 9,000 feet before being siphoned beneath Indian Slough to Byron Tract. The setback levee channel would be created by the construction of a setback levee roughly parallel with Old River, set back about 500 feet to the west. The west side of the Old River levee would then become the east bank of the isolated conveyance channel. The siphon structure would consist of six 30' x 30' concrete boxes to convey 15,000 cfs 700 feet from Orwood Tract to Byron Tract.

Byron Tract

Water entering Byron Tract from Orwood Track would enter the setback levee channel and continue south on Byron Tract to Highway 4. The channel would be created by constructing a setback levee parallel with Old River, set back approximately 500 feet to the west. The west side

of the Old River levee would then become the east bank of the isolated conveyance channel. A siphon located at Highway 4 would convey water beneath Old River to the southern half of Victoria Island. This siphon structure would consist of six 30' x 30' concrete boxes to convey 15,000 cfs 600 feet from Byron Tract to Victoria Island, which lies east of Old River and just north of Clifton Court Forebay.

Victoria Island

Water entering Victoria Island from Byron Island would enter the setback levee channel and would continue south for about 13,500 feet. The isolated channel would be created by the construction of a setback levee parallel to Old River, set back about 500 feet to the east. The west side of the Old River levee would becomes the east bank of the isolated conveyance channel. At the southern end of Victoria Island a siphon would convey water beneath Old River to Clifton Court Forebay. This siphon would consist of six 30' x 30' concrete boxes to convey 15,000 cfs 1,300 feet from Victoria Island to Clifton Court Forebay.

Eastern Intake

In general, the Eastern Intake would include a 14-mile earthlined isolated conveyance channel complete with an intake structure, two under-river siphon crossings, and associated works. The Eastern Intake would require construction of new facilities on two Delta islands, Upper Roberts Island and Union Island. Water would be diverted from the San Joaquin River through a low-lift pumping plant to Upper Roberts Island and conveyed west through Union Island to Clifton Court Forebay. A concrete transition would be constructed between the intake structure and the pumping plant. The Eastern Intake would have a 2,000-foot-wide alignment for its entire length. This alignment would require the construction of nine bridges and crossings.

As shown in Figure 5, the typical cross section of the isolated conveyance facility would generally consist of a trapezoidal section with slide slopes of 3:1. Back slopes would be 2:1, and

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special treatment would be required in areas where the peat soil may pose a threat to stability. The Eastern Intake would have an alignment 2,000 feet wide for the entire length. The main conveyance channel would consist of an open channel located in the center of the alignment. Located on either side of the channel would be a 20-foot-wide O&M road. The 15,000 cfs channel would generally have a top width of 350 feet, a bottom width of 140 feet, and a depth of 28 feet from the normal operating water surface elevation. The capacity of channel and all the related facilities is 15,000 cfs. The Eastern Intake would require the construction of 10 bridges. Detailed below are more complete descriptions of the facilities on each of the islands that comprise the Eastern Intake component configuration.

Upper Roberts Island

The intake for the Eastern Intake would consist of a gated intake facility located on the east side of the Upper Roberts Island on the San Joaquin River. This intake facility would consist of five 20' x 20' Tainter Gates with a capacity of 15,000 cfs. For the Eastern Intake, a low-lift pumping plant is required to provide sufficient hydraulic head for gravity flow to Clifton Court Forebay. The 15,000 cfs pumping plant would consist of eleven 1,500 cfs units, including one standby, and would have a total horsepower of 25,080 and a total dynamic head of 10 feet. From the intake and pumping plant water would be enter the earthlined, open channel and would continue west for about four miles to Middle River. At this location the channel would siphon beneath Middle River to Union Island. This siphon would consist of six 30' x 30' concrete boxes which would convey 15,000 cfs 200 feet from Roberts Island to Union Island.

Union Island

Water entering Union Island from Upper Roberts Island would continue southwest through an earthlined channel towards the Grant Line Canal and Fabian and Bell Canals. The alignment then turns west and parallels the canals for about nine miles to the canals confluence with Old River. At this location a siphon would convey water beneath Old River to Byron Tract where the

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open channel continues northwest for one-third of a mile before reaching Clifton Court Forebay. This siphon would consist of six 30' x 30' concrete boxes to convey 15,000 cfs 600 feet from Union Island to Clifton Court Forebay.

CVP-SWP Improvements

Modifications at Clifton Court Forebay would include a new gated intake structure at the north end of the forebay, directly across from the setback channel on Victoria Island. This new intake would enable more rapid filling of Clifton Court Forebay from flows conveyed through the setback channel. The Skinner Delta Fish Protective Facility, which screens diversions for the SWP's Banks Pumping Plant, would be upgraded with state-of-the-art fish screens. The new screens would be of the Folded-V type and would be designed under the guidance of the CDFG. Modifications to the SWP and CVP Delta pumping facilities would increase the operational flexibility of diverting water from the Delta and reducing the impacts associated with current diversions.

An interconnection between Clifton Court Forebay and lower portion of the Delta-Mendota Canal would also be constructed on the south side of the forebay. This interconnection would allow water stored in the forebay to be diverted to the CVP's Tracy Pumping Plant for pumping and delivery to the Delta-Mendota Canal. The interconnection would be gated to maximize the operational flexibility of the system. An additional gate would be constructed on the Delta-Mendota Canal just downstream of the interconnection. The gate on the Delta-Mendota Canal would enable flows to be released into the Delta-Mendota Canal from Clifton Court Forebay during low tide conditions. The existing fish screens associated with the Tracy Pumping Plant would be upgraded to state-of-the-art screens similar to those that would be installed at the Skinner facility.

COST ESTIMATE

The Multiple Intakes Option is a new project that has not been previously studied; thus, there is no specific previous information describing or estimating the cost of this project. There are, however, some studies with similar components from which comparative costs can be derived. The cost estimate for the Multiple Intakes Option was developed primarily by Bookman-Edmonston Engineering and was based on available information, previous experience, and engineering judgment. These previous studies include the *1993 DWR, ISDP Cost Estimate: Proposed Clifton Court Forebay Northern Intake Structure* and the 1995 DWR report *Isolated Transfer Facility Cost Estimate.*

COST ESTIMATE METHODOLOGY

General

The cost estimates for the Multiple Intakes Option were determined by applying current unit costs to the quantities developed by Bookman-Edmonston Engineering. Some of the costs used to update this cost estimate were determined by escalating the unit cost to October 1996 dollars using Reclamation's Construction Cost Trends (CCT) indices. Additional unit costs were developed by Bookman-Edmonston Engineering based on engineering and construction experience. The cost estimate does not include the cost of environmental documentation, environmental mitigation, operation and maintenance, power, and interest during construction.

Table 2 provides a detailed breakdown of the estimated costs of the Multiple Intakes Option. Cost items identified in previous cost estimates have been provided, along with the unit cost of the items or an indication that the estimated cost has been developed through a lump sum approach. The tables also include the Reclamation CCT index for the month and year in which the estimated cost was developed and for October 1996. These Reclamation cost indices are used to factor the previous cost estimate to October 1996 dollars. In some instances, only a unit

cost has been provided, with no cost indices. In these cases, the unit cost has been taken from other sources. The far right-hand column of Table 2 provides the cost reference for each cost item.

Pumping Plants

The cost estimate for the Pumping Plants associated with the Multiple Intakes Option has been based on the cost and quantities from the September 1995 DWR Report, *Isolated Transfer Facility Cost Estimate*. These costs were originally priced in July 1995 dollars and have been updated to October 1996 dollars using the CCT indices described above.

Right-of-Way Costs

Right-of-way costs of $3,000 per acre were used based on land use costs developed by Reclamation's, Land Resources Branch (Personal Communication, February 1997). The right-of-way necessary for the development of the Multiple Intakes Option would require 8,110 acres. In addition, the Western Intake component would require relocation of irrigation diversions and drainage pumps on Palm Tract, Orwood Tract, Byron Tract, and Victoria Island that would involve an additional 8,400 acres at an estimated cost of $1,000 per acre. Similarly, the Eastern Intake component would involve the relocation of irrigation diversions and drainage pumps involving 8,350 acres on Union Island at an estimated cost of $1,000 per acre.

Contingencies and Other Costs

All contingencies and engineering, construction management, and administrative factors were determined by engineering judgement based on similar level of cost estimation. Contingencies were chosen to be 20 percent, and engineering, construction management, and administration were chosen to be 35 percent. A cost range was developed for the project by subtracting

10 percent from the estimated capital cost for the low end cost and adding 25 percent to the estimated capital cost for the high end.

PRELIMINARY COST FINDINGS

Costs of the Multiple Intakes Option and supporting facilities have been developed to an October 1996 basis as described above. Table 3 summarizes estimated costs of the major items associated with the Multiple Intakes Option.

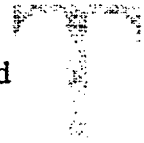
The total estimated capital cost of the Multiple Intakes Option is estimated to be about $1,867 million with a resulting calculated cost range between $1,680 and $2,334 million.

ENVIRONMENTAL CONSIDERATIONS

[NOTE: The environmental considerations section needs to be reevaluated by DWR to ensure consistency with the information presented in the previous section.]

This portion of the report provides a summary of environmental considerations related to the Multiple Intakes Option. Fish, wildlife, plant, and cultural resources that could be affected by the proposal are described and the extent of the impacts is identified. The information presented in this section was gathered from existing literature, with limited original research. No field work was conducted for this analysis.

WILDLIFE



The Multiple Intakes Option would impact approximately 6,000 acres of agricultural lands and terrestrial wildlife habitat. Almost all of these lands are presently in agricultural use.

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Fish, Amphibians, Reptiles, and Invertebrates

The Multiple Intakes Option could affect several waterways which support both anadromous and resident game and non-game fish. Depending on outflow regimes and water year hydrology, the Delta supports several types of habitats including estuary, freshwater, and marine water environments. In all, the Delta's various water environments support about 90 species of fish. Fish dependant on the Delta as a migration corridor, nursery, or permanent residents include striped bass, chinook salmon. steelhead trout, American shad, sturgeon, catfish, largemouth bass, winter-run chinook salmon, Delta smelt, Sacramento splittail and numerous other marine and freshwater species.

California tiger salamander is found in the Delta. This species requires quiet, still water for breeding. The major waterways in the area are deep, swift, and subject to frequent inundation to provide suitable habitat for this species. Many of the irrigation ditches in the area are kept clear of aquatic vegetation, while the surrounding lands are intensively cultivated, further reducing suitable habitat for tiger salamanders.

General Wildlife

Lands within the areas of the proposed project support a highly diverse wildlife. Important groups of wildlife dependant on the Delta are waterfowl and other migratory birds, game birds such as pheasant and quail, furbearers, and numerous nongame birds and mammals. The Delta is particularly important to waterfowl migrating via the Pacific Flyway. The principal attraction for waterfowl is winter flooded agricultural fields, mainly cereal crops, which provide food and extensive seasonal wetlands. Small mammals find suitable habitat in the Delta and upland areas. Vegetated levees, remanent of riparian forest, and undeveloped islands provide habitat for numerous small mammals. Small mammal species include muskrat, mink, river otter, beaver, raccoon, gray fox, and skunks. A variety of non-game wildlife such as songbirds, hawks, owl, reptiles, and amphibians can also be found in the area.

Sensitive and Listed Fish and Wildlife Species

According to the CDFG's National Diversity Database, listed wildlife species that have been recorded in or around the area that would be directly affected by the proposed project include California red-legged frog (federal threatened), Swainson's hawk (State threatened), California black rail (State threatened), and San Joaquin kit fox (federal endangered, State threatened).

Other unrecorded listed species that could potentially occur in the area include American peregrine falcon (federal endangered), Aleutian Canada goose (FT), bald eagle (FT, SE), winter-run chinook salmon (FE), Delta smelt (FT), and Delta green ground beetle (FT).

Wildlife species that are either candidates for State or federal listing or considered "species of special concern" by the CDFG that have been known to occur in the area affected by the proposed project include California tiger salamander (federal candidate, species of special concern), white-tailed kite, burrowing owl (species of special concern), San Joaquin pocket mouse (species of special concern), and western pond turtle.

Limited sporadic use of the project area may also occur for wintering greater sandhill cranes. This species (State-listed threatened) is a common winter migrant to the eastern Sacramento Valley. While the crane does not nest in the project area it could use the open grasslands for foraging.

Bald eagle, peregrine falcon, yellow-billed cuckoo, and Aleutian Canada goose have been observed in the Delta, but none are confined exclusively to the area.

VEGETATION

The Multiple Intakes Option would affect approximately 6,000 acres of agricultural and disturbed lands. Most of these lands are presently used for agriculture.

Sensitive and Listed Plant Species

A federal candidate, State listed Endangered plant, Mason's lilaeopsis, has been known to occur in or around the area of the proposed project. Delta button-celery (federal candidate, State endangered) could also be affected by this alternative.

Candidate plant species for federal listing that may occur in the area include Suisun marsh aster, caper-fruited tropidocarpum, San Joaquin saltbush, ferris's milk vetch, Delta tule pea, and recurved larkspur.

Additional plants listed by the California Native Plant Society as being rare, threatened or endangered in California and elsewhere, could also be affected by the proposed Multiple Intakes Option. These plants include big tarweed, Wright's trichocoronis, marsh skullcap, California hibiscus, heartscale, Delta mudwort, and bristly sedge.

Special Status Habitats that may be found along or near the area of the proposed alternative include: Valley Sink Scrub; Northern Claypan Vernal Pool (see Wetlands); Alkali Meadow; Coastal and Valley Freshwater Marsh (see Wetlands); and Great Valley Oak Riparian Forest.

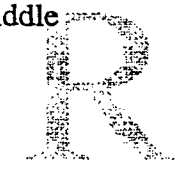
Wetlands

From information gathered from the USFWS's National Wetland Inventory map, the proposed Multiple Intakes Option would have impacts at the three intake areas.

The western intake would impact approximately nine miles of farmed wetlands, over two miles of scrub-shrub seasonal tidal wetlands, seven acres of scrub-shrub seasonally flooded wetlands (shallow marsh), and 29 acres scrub-shrub/emergent semipermanent saturated wetlands (deep marsh).

The northern intake would impact approximately 18 miles of farmed wetlands, over two miles of scrub-shrub seasonal tidal wetlands, ten acres of scrub-shrub seasonal tidal wetlands, three miles of aquatic bed intermittently exposed, 29 acres of scrub-shrub/emergent semipermanently saturated wetlands (deep marsh), 40 acres of emergent saturated semipermanent wetlands (deep marsh), one mile scrub-shrub seasonally flooded wetlands (shallow marsh), and seven miles of scrub-shrub seasonally flooded wetlands (shallow marsh). This intake would cross Middle River and the Mokelumne Aqueduct.

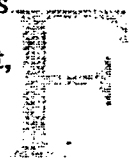
The eastern intake would impact approximately six miles of farmed wetlands, six miles of forested/scrub-shrub temporary tidal wetlands, one mile of scrub-shrub seasonal tidal wetlands, and four miles of scrub-shrub/emergent seasonal tidal wetlands. This intake would cross Middle River.



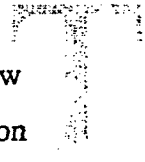
Three special status wetland habitats, Northern Claypan Vernal Pool, Alkali Meadow, and Coastal and Valley Freshwater Marsh, could be affected by the proposed Multiple Intakes Option.

CULTURAL RESOURCES

Archaeological sites throughout the Delta province may be over represented. Historic activities connected with channel dredging, levee construction and maintenance, residential development, and agriculture have obscured, buried, and destroyed many sites since the first half of the 20th century, when most were first found. Additionally, some may now also be buried under alluvium.



Prehistoric settlements in the delta were situated on low rises above flood level, mounds on low knolls, natural levees, and on higher ground along the banks of streams and rivers. Reclamation and farming activities have leveled most of these areas of higher relief. Field inspection will be necessary to verify the existence and condition of these sites for a more accurate assessment.



D-005232

Historic period sites and features in the Delta province are generally under represented. The surveys responsible for identifying most of the archaeological sites were performed by the University of California, Berkeley, during the time when there was little concern for historic period resources. Almost all of them have been recorded since the 1970s.

In addition to farmsteads, ranches, and townsites, there are resources noted on the quadrangle maps that would require evaluation. These resources include levees, pumphouses, pumping stations, windmills, railroad grades, roads and bridges, pilings, piers, landings, and gas wells.

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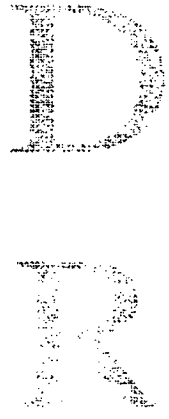

Table 1
SUMMARY OF PHYSICAL CHARACTERISTICS
MULTIPLE INTAKES OPTION

	Northern Intakes	Western Intakes	Eastern Intakes
Intake Facilities			
Tainter Gates (quantity)	5	5	5
Tainter Gates (size)	20'x50'	20'x50'	20'x50'
Pumping Plant			
Capacity (cfs)	5,000	--	5,000
11 Pumps (1 standby) (cfs)	1,500	--	1,500
Total Dynamic Head (feet)\	10	--	10
Total Plant Horsepower (HP)	25,080	--	25,080
Earth Channel			
Length (miles)	14	8	14
Top Width (feet)	350	500	350
Bottom Width (feet)	140	350-380	140
Depth (feet)	28	15	28
Side Slopes	3:1	3:1	3:1
Embankment (cubic yards)	10,712,000	N/A	12,106,000
Compacted Embankment Volume (cubic yards)	14,871,000	N/A	2,648,000
Common Embankment (cubic yards)	6,021,000		1,334,000
Right-of-Way (acres)	3,400	1,358	3,352
Siphons			
Typical Number and Size	six 30'x30'	six 30'x30'	six 30'x30'
Northern Intake			
Old River Siphon (length in feet)	600	--	--
Middle River Siphon (length in feet)	700	--	--
West Canal Siphon (length in feet)	400	--	--
Western Intake			
Mokelumne River Aqueduct and RR Siphon (length in feet)	--	1,300	--
Indian Slough Siphon (length in feet)	--	700	--
Old River and Highway 4 Bridge Siphon (length in feet)	--	600	--
Siphon Under Old River into Clifton Court Forebay (length in feet)	--	1,300	--
Eastern Intake			
Middle River Siphon (length in feet)	--	--	200
Old River Siphon (length in feet)	--	--	600
CVP-SWP Improvements			
New Clifton Court Intake from Victoria Island Setback Channel			
Capacity (cfs)			10,300
Siphon Length (feet)			2,800
Number of Radial Gates			2
New Interconnection Between Clifton Court Forebay and Delta-Mendota Canal			
Capacity (cfs)			10,300
Number of Radial Gates			2
New Radial Gate Control Structure on Delta-Mendota Canal			
Capacity (cfs)			10,300
Number of Radial Gates			2
Upgraded Fish Screens at Skinner Delta Fish Protection Facility			
Screen type			Folded-V
Capacity (cfs)			10,300
Upgraded Fish Screens at the Tracy Pumping Plant			
Screen type			Folded-V
Capacity (cfs)			10,300

Table 2
ESTIMATED CAPITAL COSTS
MULTIPLE INTAKES OPTION

DESCRIPTION	QUANTITY	UNIT	USBR INDEX APR. 91	USBR INDEX OCT. 96	UNIT COST APR. 91	UNIT COST OCT. 96	TOTAL COST OCT. 96	COST REFERENCE
NORTHERN 15,000 CFS ISOLATED SOUTH DELTA INTAKE								
I. INTAKE FACILITIES								
20'x50' Tainter Gates	5	EACH				$510,000	$2,550,000	1
Concrete	8,000	CY				$600.00	$4,800,000	1
Dewatering	JOB	LS				$150,000.00	$150,000	1
Electrical Works	JOB	LS				$500,000.00	$500,000	1
Miscellaneous Cost @10%							$800,000	
SUBTOTAL INTAKE FACILITIES							$8,800,000	
II. PUMPING PLANT								
Q= 15,000 cfs, TDH = 10', 11 ea. 2,280 HP unit (1 Stand-by)								
Pumps and Prime movers	JOB	LS				$35,864,000.00	$35,864,000	2
Structures and Improvements	JOB	LS				$19,544,000.00	$19,544,000	2
Electrical Equipment	JOB	LS				$3,698,000.00	$3,698,000	2
SUBTOTAL PUMPING PLANT							$59,106,000	
III. EARTH CANAL								
Embankment	10,712,000	CY				$2.00	$21,424,000	1
Compacted Embankment	14,871,000	CY				$0.80	$11,897,000	1
Common Embankment	6,021,000	CY				$0.50	$3,011,000	1
Borrow	17,616,000	CY				$5.00	$88,080,000	1
Fencing	148,000	LF				$5.00	$740,000	
SUBTOTAL EARTH CANAL							$125,152,000	
IV. MIDDLE RIVER SIPHON								
6-30'x30' Concrete Box Including Rebar and Earthworks	86,800	CY				$600.00	$52,080,000	1
Transitions Concrete	7,000	CY				$600.00	$4,200,000	1
Riprap	20,000	CY				$50.00	$1,000,000	1
Dewatering	JOB	LS				$1,200,000.00	$1,200,000	1
Miscellaneous @ 5%							$2,924,000	
SUBTOTAL MIDDLE RIVER SIPHON							$61,404,000	
V. OLD RIVER SIPHON								
6- 30'x30' Concrete Box Including Rebar and Earthworks	74,400	CY				$600.00	$44,640,000	1
Transitions Concrete	7,000	CY				$600.00	$4,200,000	1
Riprap	20,000	CY				$50.00	$1,000,000	1
Dewatering	JOB	LS				$1,200,000.00	$1,200,000	1
Miscellaneous @ 5%							$2,552,000	
SUBTOTAL OLD RIVER SIPHON							$53,592,000	
VI. WEST CANAL SIPHON								
6-30'x30' Concrete Box Including Rebar and Earthworks	49,600	CY				$600	$29,760,000	1

D-005237

Table 2
ESTIMATED CAPITAL COSTS
MULTIPLE INTAKES OPTION

DESCRIPTION	QUANTITY	UNIT*	USBR INDEX APR. 91	USBR INDEX OCT. 96	UNIT COST APR. 91	UNIT COST OCT. 96	TOTAL COST OCT. 96	COST REFERENCE
Transitions Concrete	7,000	CY				$600.00	$4,200,000	1
Riprap	20,000	CY				$50.00	$1,000,000	1
Dewatering	JOB	LS				$1,200,000.00	$1,200,000	1
Miscellaneous @ 5%							$1,808,000	
SUBTOTAL WEST CANAL SIPHON							$37,968,000	
VII. COUNTY ROAD BRIDGES								
One Bridge	16,800	SF				$100.00	$1,680,000	1
SUBTOTAL COUNTY ROAD BRIDGES							$1,680,000	
VIII. FARM AND PRIVATE ROAD BRIDGES								
8 Bridges @ 12,000 sq. ft.	96,000	SF				$100.00	$9,600,000	1
SUBTOTAL FARM AND PRIVATE ROAD BRIDGES							$9,600,000	
IX. RAILROAD BRIDGE								
A.T. & S.F. R.R. Bridge	JOB	LS				$2,450,000.00	$2,450,000	2
SUBTOTAL RAILROAD BRIDGE							$2,450,000	
X. LAND COST	3,400	AC				$3,000.00	$10,200,000	1
SUBTOTAL							$369,952,000	
WESTERN 15,000 CFS ISOLATED SOUTH DELTA INTAKE								
I. INTAKE FACILITIES								
20'x50' Tainter Gates	5	EACH				$510,000	$2,550,000	1
Concrete	8,000	CY				$600.00	$4,800,000	1
Dewatering	JOB	LS				$150,000.00	$150,000	1
Electrical Works	JOB	LS				$500,000.00	$500,000	1
Miscellaneous Cost @10%							$800,000	
SUBTOTAL INTAKE FACILITIES							$8,800,000	
II. STRENGTHENING OF EXISTING LEVEES								
Strengthening of West Levee of Old River North of Hwy. 4								
and East Levee of Old River South of Hwy. 4 with Riprap,								
Bedding, and Geotextile	56,800	LF				$319.32	$18,137,000	1
SUBTOTAL STRENGTHENING OF EXISTING LEVEES							$18,137,000	
III. CONSTRUCT NEW SETBACK LEVEES								
Construct New Setback Levees for Conveyance Channel,								
with Riprap, Bedding, and Geotextile on Channel Side of Slope.	45,000	LF				$1,433.30	$64,499,000	1
Fencing	45,000	LF				$5.00	$225,000	
SUBTOTAL CONSTRUCT NEW SETBACK CHANNEL							$64,724,000	

D-005238

Table 2
ESTIMATED CAPITAL COSTS
MULTIPLE INTAKES OPTION

	DESCRIPTION	QUANTITY	UNIT	USBR INDEX APR. 91	USBR INDEX OCT. 96	UNIT COST APR. 91	UNIT COST OCT. 96	TOTAL COST OCT. 96	COST REFERENCE
IV.	MOKELUMNE RIVER AQUEDUCT AND R.R. SIPHON								
	6-30'x30' Concrete Box	161,200	CY				$600.00	$96,720,000	1
	Riprap	25,000	CY				$50.00	$1,250,000	1
	Dewatering	JOB	LS				$1,500,000.00	$1,500,000	1
	Railroad Detour	JOB	LS				$500,000.00	$500,000	1
	Miscellaneous @ 5%							$4,999,000	
	SUBTOTAL MOKELUMNE RIVER AQUEDUCT AND R.R. SIPHON							$104,969,000	
V.	INDIAN SLOUGH SIPHON								
	6- 30'x30' Concrete Box	86,800	CY				$600.00	$52,080,000	1
	Riprap	25,000	CY				$50.00	$1,250,000	1
	Dewatering	JOB	LS				$200,000.00	$200,000	
	Miscellaneous @ 5%							$2,677,000	
	SUBTOTAL INDIAN SLOUGH SIPHON							$56,207,000	
VI.	OLD RIVER AND HWY. 4 BRIDGE SIPHON								
	6- 30'x30' Concrete Box	74,400	CY				$600	$44,640,000	1
	Riprap	25,000	CY				$50.00	$1,250,000	1
	Dewatering	JOB	LS				$500,000	$500,000	1
	Hwy. 4 Bridge	84,000	SF				$100	$8,400,000	1
	Miscellaneous @ 5%							$2,740,000	
	SUBTOTAL OLD RIVER AND HWY. 4 BRIDGE SIPHON							$57,530,000	
VII.	OLD RIVER SIPHON INTO CLIFTON COURT FOREBAY								
	6- 30'x30' Concrete Box	161,200	CY				$600	$96,720,000	1
	Transition Concrete (Forebay)	4,000	CY				$600	$2,400,000	1
	Riprap	25,000	CY				$50.00	$1,250,000	1
	Dewatering and Coffer Dam	JOB	LS				$1,000,000	$1,000,000	1
	Miscellaneous @ 5%							$5,069,000	
	SUBTOTAL OF OLD RIVER SIPHON							$106,439,000	
VIII.	RELOCATION OF IRRIGATION DIVERSIONS AND DRAINAGE PUMPS								
	Palm Track	2,000	AC				$1,000	$2,000,000	1
	Orwood Track	2,000	AC				$1,000	$2,000,000	1
	Byron Track	2,000	AC				$1,000	$2,000,000	1
	Victoria Island	2,400	AC				$1,000	$2,400,000	1
	Miscellaneous @ 10%							$840,000	
	SUBTOTAL RELOCATION FO IRRIGATION DIVERSIONS								
	AND DRAINAGE PUMPS							$9,240,000	
IX.	LAND COST								
	Palm Track	505	AC				$3,000	$1,515,000	1
	Orwood Track	264	AC				$3,000	$792,000	1

D-005239

Table 2
ESTIMATED CAPITAL COSTS
MULTIPLE INTAKES OPTION

	DESCRIPTION	QUANTITY	UNIT*	USBR INDEX APR. 91	USBR INDEX OCT. 96	UNIT COST APR. 91	UNIT COST OCT. 96	TOTAL COST OCT. 96	COST REFERENCE
	Byron Track	280	AC				$3,000	$840,000	1
	Victoria Island	309	AC				$3,000	$927,000	1
	SUBTOTAL RAILROAD BRIDGE							$4,074,000	
	SUBTOTAL							$430,120,000	
EASTERN 15,000 CFS ISOLATED SOUTH DELTA INTAKE									
I.	INTAKE FACILITIES								
	20'x50' Tainter Gates	5	EACH				$510,000	$2,550,000	1
	Concrete	8,000	CY				$600.00	$4,800,000	1
	Dewatering	JOB	LS				$150,000.00	$150,000	1
	Electrical Works	JOB	LS				$500,000.00	$500,000	1
	Miscellaneous Cost @10%							$800,000	
	SUBTOTAL INTAKE FACILITIES							$8,800,000	
II.	PUMPING PLANT								
	Q= 15,000 cfs, TDH = 10', 11 ea. 2,280 HP unit (1 Stand-by)								
	Pumps and Prime movers	JOB	LS				$35,864,000.00	$35,864,000	2
	Structures and Improvements	JOB	LS				$19,544,000.00	$19,544,000	2
	Electrical Equipment	JOB	LS				$3,698,000.00	$3,698,000	2
	SUBTOTAL PUMPING PLANT							$59,106,000	
III.	EARTH CANAL								
	Embankment	12,106,000	CY				$2.00	$24,212,000	1
	Compacted Embankment	2,648,000	CY				$0.80	$2,118,000	1
	Common Embankment	1,334,000	CY				$0.50	$667,000	1
	Strengthening of Existing Levee - North Levee of Grant Line Canal	40,000	LF				$319.32	$12,773,000	1
	Fencing	146,000	LF				$5.00	$730,000	1
	SUBTOTAL EARTH CANAL							$40,500,000	
IV.	MIDDLE RIVER SIPHON								
	6-30'x30' Concrete Box Including Rebar and Earthworks	24,800	CY				$600.00	$14,880,000	1
	Transitions Concrete	7,000	CY				$600.00	$4,200,000	1
	Riprap	20,000	CY				$50.00	$1,000,000	1
	Dewatering	JOB	LS				$1,200,000.00	$1,200,000	1
	Miscellaneous @ 5%							$1,064,000	
	SUBTOTAL MIDDLE RIVER SIPHON							$22,344,000	
V.	OLD RIVER SIPHON								
	6- 30'x30' Concrete Box Including Rebar and Earthworks	74,400	CY				$600.00	$44,640,000	1
	Transitions Concrete	7,000	CY				$600.00	$4,200,000	1
	Riprap	20,000	CY				$50.00	$1,000,000	1
	Dewatering	JOB	LS				$1,200,000.00	$1,200,000	1

D-005240

Table 2
ESTIMATED CAPITAL COSTS
MULTIPLE INTAKES OPTION

	DESCRIPTION	QUANTITY	UNIT*	USBR INDEX APR. 91	USBR INDEX OCT. 96	UNIT COST APR. 91	UNIT COST OCT. 96	TOTAL COST OCT. 96	COST REFERENCE
	Miscellaneous @ 5%							$2,552,000	
	SUBTOTAL OLD RIVER SIPHON							$53,592,000	
VI.	FARM AND PRIVATE ROAD BRIDGES								
	8 Bridges @ 12,000 sq. ft.	96,000	SF				$100.00	$9,600,000	1
	SUBTOTAL FARM AND PRIVATE ROAD BRIDGES							$9,600,000	
VII.	COUNTY ROAD BRIDGES								
	One Bridge	16,800	SF				$100.00	$1,680,000	1
	SUBTOTAL COUNTY ROAD BRIDGES							$1,680,000	
VIII.	RELOCATION OF IRRIGATION DIVERSIONS AND DRAINAGE PUMPS								
	Union Island	8350	AC				$1,000.00	$8,350,000	1
	Miscellaneous @ 10%							$835,000	
	SUBTOTAL RELOCATION OF IRRIGATION DIVERSIONS AND								
	DRAINAGE PUMPS							$9,185,000	
X.	LAND COST	3,352	AC				$3,000.00	$10,056,000	1
	SUBTOTAL							$214,863,000	
CVP-SWP IMPROVEMENTS									
I.	CLIFTON COURT FOREBAY								
	New Intake at North End of Clifton Court Forebay	JOB	LS				$13,640,000	$13,640,000	3
	Fish Screens at Skinner Fish Facility	JOB	LS				$52,000,000	$52,000,000	1
	SUBTOTAL CLIFTON COURT FOREBAY							$65,640,000	
II.	TRACY PUMPING PLANT								
	Interconnection Channel with Gated Structures:								
	2,800 lin. ft. of Earth Canal, Q=10,300 cfs:								
	Excavation	375,000	CY				$2.00	$750,000	1
	Compacted Embankment	486,000	CY				$0.80	$389,000	1
	Common Embankment	203,000	CY				$0.50	$102,000	1
	Borrow	557,000	CY				$5.00	$2,785,000	1
	Land Cost	129	AC				$3,000	$387,000	1
	Intake Structure with Radial Gates at Clifton Court Forebay	JOB	LS				$9,135,000	$9,135,000	3
	Extra Set of Radial Gates Below Interconnection Channel	JOB	LS				$6,798,000	$6,798,000	1
	Fish Screen at Tracy Pumping Plant	JOB	LS				$51,500,000	$51,500,000	1
	SUBTOTAL TRACY PUMPING PLANT							$71,846,000	
	SUBTOTAL CVP - SWP IMPROVEMENTS							$137,486,000	

Table 2
ESTIMATED CAPITAL COSTS
MULTIPLE INTAKES OPTION

DESCRIPTION	QUANTITY	UNIT*	USBR INDEX APR. 91	USBR INDEX OCT. 96	UNIT COST APR. 91	UNIT COST OCT. 96	TOTAL COST OCT. 96	COST REFERENCE
SUBTOTAL							$1,152,421,000	
CONTINGENCIES @ 20%							$230,484,000	
SUBTOTAL							$1,382,905,000	
ENG., LEGAL, AND ADM. @ 35%							$484,017,000	
TOTAL PROJECT COST							$1,866,922,000	
TOTAL PROJECT COST RANGE								
LOW (-10%)							$1,680,230,000	
HIGH (+25%)							$2,333,653,000	

Footnotes:

*CY=cubic yard; LB=pound; EA=each; LS=lump sum; LF=linear foot; SF=square foot; TON=ton; MI=mile; AC=acre

Cost Reference:

1. Cost developed by Bookman-Edmonston Engineering.
2. Cost developed for "Isolated Conveyance Facilities - 15,000 cfs" Cost Estimate
3. California Department of Water Resources, ISDP Cost Estimate: Proposed Clifton Court Forebay Northern Intake Structure, October 1993

D-005242

Table 3
SUMMARY OF ESTIMATED CAPITAL COSTS
MULTIPLE INTAKES OPTION

Cost Item	Estimated Cost ($Millions)
Northern Intakes	
Intake Facilities	8.8
Pumping Plant	59.1
Earth Canal	125.2
Middle River Siphon	61.4
Old River Siphon	53.6
West Canal Siphon	38.0
County Road Bridges	1.7
Farm and Private Road Bridges	9.6
Railroad Bridge	2.4
Land Cost	10.2
Subtotal	**370.0**
Western Intakes	
Intake Facilities	8.8
Strengthening of Existing Levees	18.1
Construction of New Setback Levees	64.7
Modelumne River Aqueduct and R.R. Siphon	105.0
Indian Slough Siphon	56.2
Old River and Highway 4 Bridge Siphon	57.5
Old River Siphon into Clifton Court Forebay	106.5
Relocation of Irrigation Diversions and Drainage Pumps	9.2
Land Cost	4.1
Subtotal	**430.1**
Eastern Intakes	
Intake Facilities	8.8
Pumping Plant	59.1
Earth Canal	40.5
Middle River Siphon	22.3
Old River Siphon	53.6
Farm and Private Road Bridges	9.6
County Road Bridges	1.7
Relocation of Irrigation Diversions and Drainage Pumps	9.2
Land Cost	10.1
Subtotal	**214.9**
CVP-SWP Improvements	
Clifton Court Forebay	65.6
Tracy Pumping Plant	71.9
Subtotal	**137.5**
TOTAL	1,152.5
Contingencies (20%)	230.5
ESTIMATED CONSTRUCTION COST	1,383.0
Engineering, Legal, and Project Administration (35%)	484.0
ESTIMATED CAPITAL COST	1,867.0
Capital Cost Range (minus 10% - plus 15%)	$1,680 - $2,334

D-005243

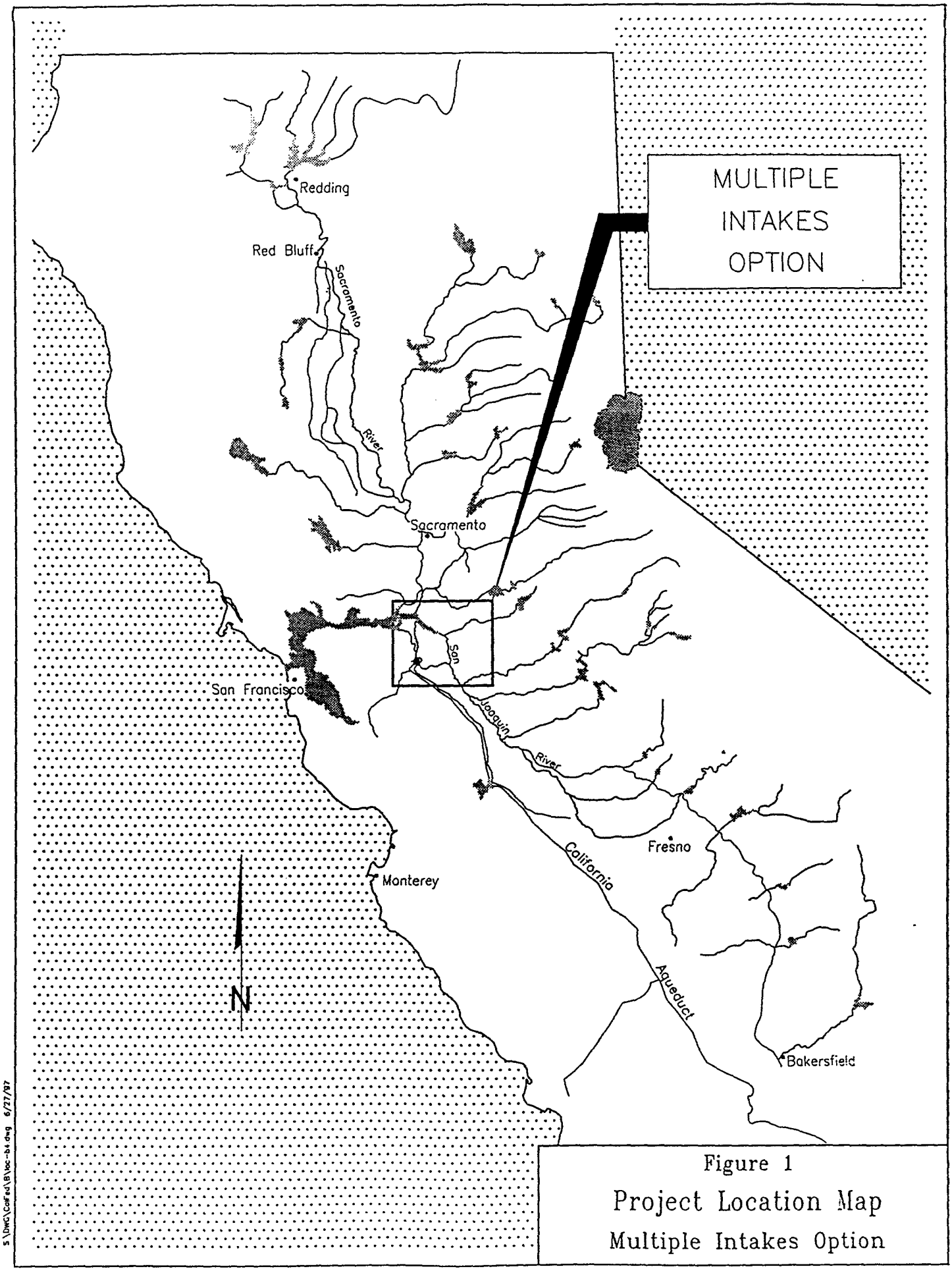

Figure 1

Project Location Map

Multiple Intakes Option

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CALFED BAY-DELTA

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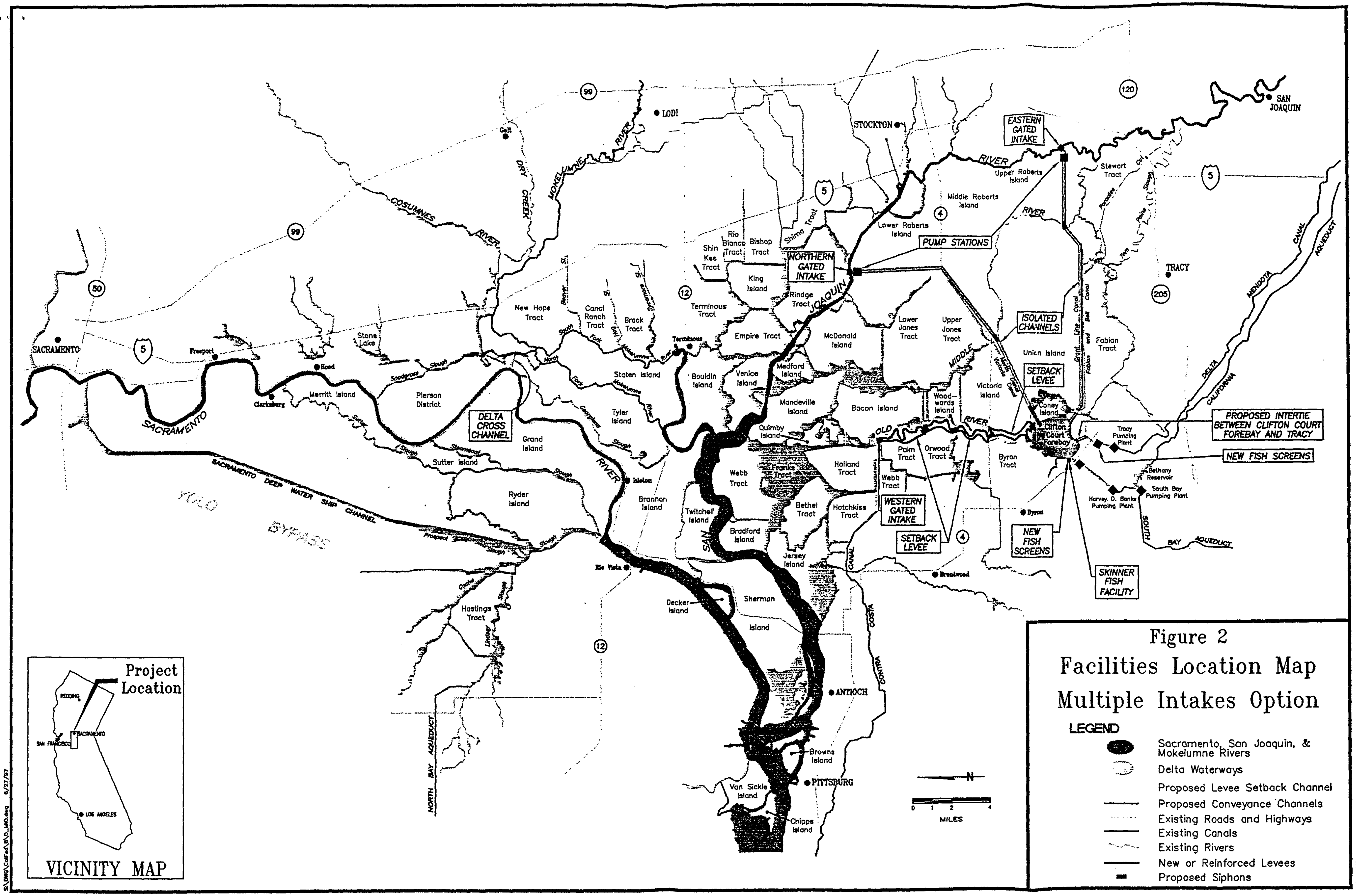
D-005244


SACRAMENTO
50
5
99
Freeport
Hood
Clarksburg
Merritt Island
SACRAMENTO
Stone Lake
Snodgrass Slough
Pierson District
COSUMNES RIVER
Galt
DRY CREEK
MOKELUMNE RIVER
LODI
New Hope Tract
Canal Ranch Tract
Brack Tract
Terminous Tract
Terminous
12
Shin Kee Tract
Rio Blanco Tract
Bishop Tract
King Island
Shima Tract
NORTHERN GATED INTAKE
Rindge Tract
JOAQUIN
STOCKTON
Lower Roberts Island
Middle Roberts Island
Upper Roberts Island
4
PUMP STATIONS
EASTERN GATED INTAKE
RIVER
120
SAN JOAQUIN
Stewart Tract
Paradise Cut
Tom Paine Slough
TRACY
205
Empire Tract
McDonald Island
Lower Jones Tract
Upper Jones Tract
ISOLATED CHANNELS
Union Island
Grant Line Canal
Fabian and Bell Canal
Fabian Tract
SETBACK LEVEE
MIDDLE
North Victoria Canal
Victoria Island
Coney Island
Clifton Court Forebay
Staten Island
Bouldin Island
Venice Island
Medford Island
Mandeville Island
Bacon Island
Woodwards Island
Tyler Island
DELTA CROSS CHANNEL
Grand Island
Sutter Island
Steamboat Slough
Georgiana Slough
Ryder Island
Isleton
Brannan Island
Quimby Island
OLD RIVER
Webb Tract
Franks Tract
Holland Tract
Palm Tract
Orwood Tract
Byron Tract
Tracy Pumping Plant
PROPOSED INTERTIE BETWEEN CLIFTON COURT FOREBAY AND TRACY
NEW FISH SCREENS
DELTA MENDOTA CANAL
CALIFORNIA AQUEDUCT
Bethany Reservoir
South Bay Pumping Plant
Harvey O. Banks Pumping Plant
SOUTH BAY AQUEDUCT
Byron
NEW FISH SCREENS
SKINNER FISH FACILITY
Twitchell Island
SAN
Bradford Island
Bethel Tract
Hotchkiss Tract
WESTERN GATED INTAKE
SETBACK LEVEE
Jersey Island
CANAL
Brentwood
YOLO BYPASS
SACRAMENTO DEEP WATER SHIP CHANNEL
Prospect Slough
Rio Vista
Cache Slough
Hastings Tract
Lindsey Slough
Decker Island
Sherman Island
CONTRA COSTA
ANTIOCH
Browns Island
PITTSBURG
Van Sickle Island
Chipps Island
NORTH BAY AQUEDUCT
N
0 1 2 4
MILES
Project Location
REDDING
SACRAMENTO
SAN FRANCISCO
LOS ANGELES
VICINITY MAP
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LEGEND
Sacramento, San Joaquin, & Mokelumne Rivers
Delta Waterways
Proposed Levee Setback Channel
Proposed Conveyance Channels
Existing Roads and Highways
Existing Canals
Existing Rivers
New or Reinforced Levees
Proposed Siphons
CALFED BAY-DELTA PROGRAM

Figure 2
Facilities Location Map
Multiple Intakes Option

D-005245

D—005245

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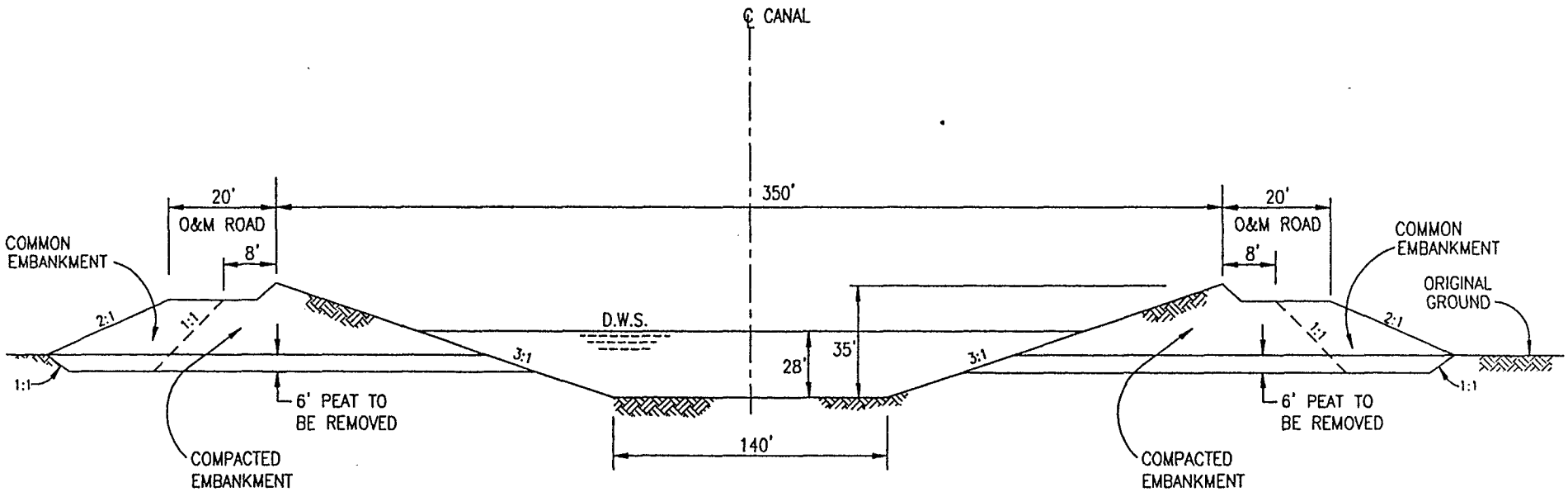

TYPICAL CANAL SECTION

NORTHERN ISOLATED SOUTH DELTA INTAKE

NOT TO SCALE

Figure 3

Typical Canal Section–Northern Intake

Multiple Intakes Option

CALFED

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D-005246

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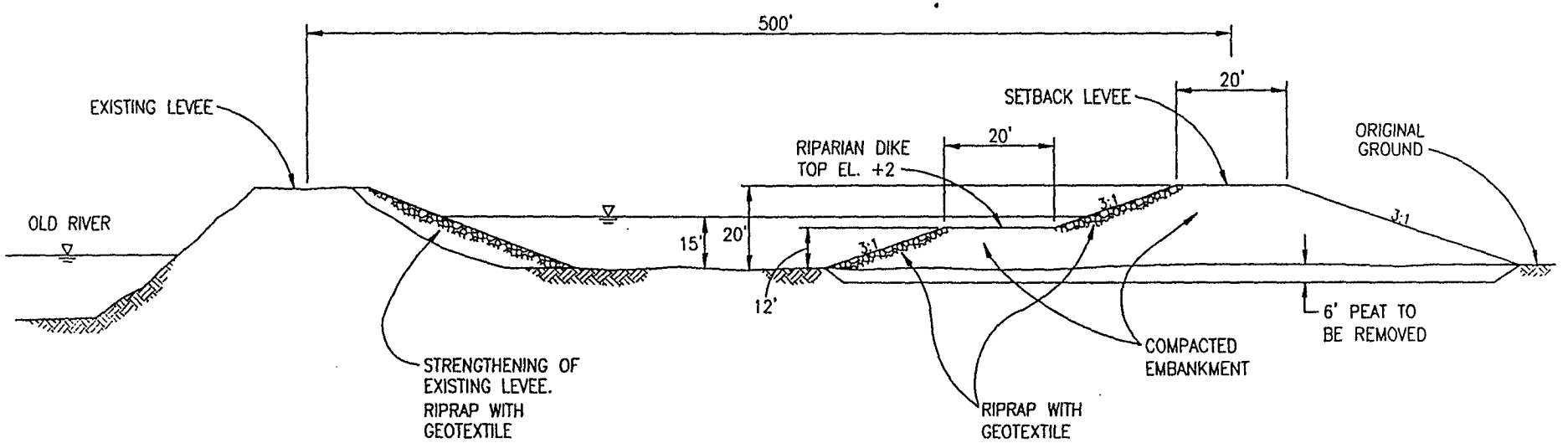

TYPICAL SECTION

WESTERN ISOLATED SOUTH DELTA INTAKE

NOT TO SCALE

Figure 4

Typical Canal Section–Western Intake

Multiple Intakes Option

CALFED BAY-DELTA

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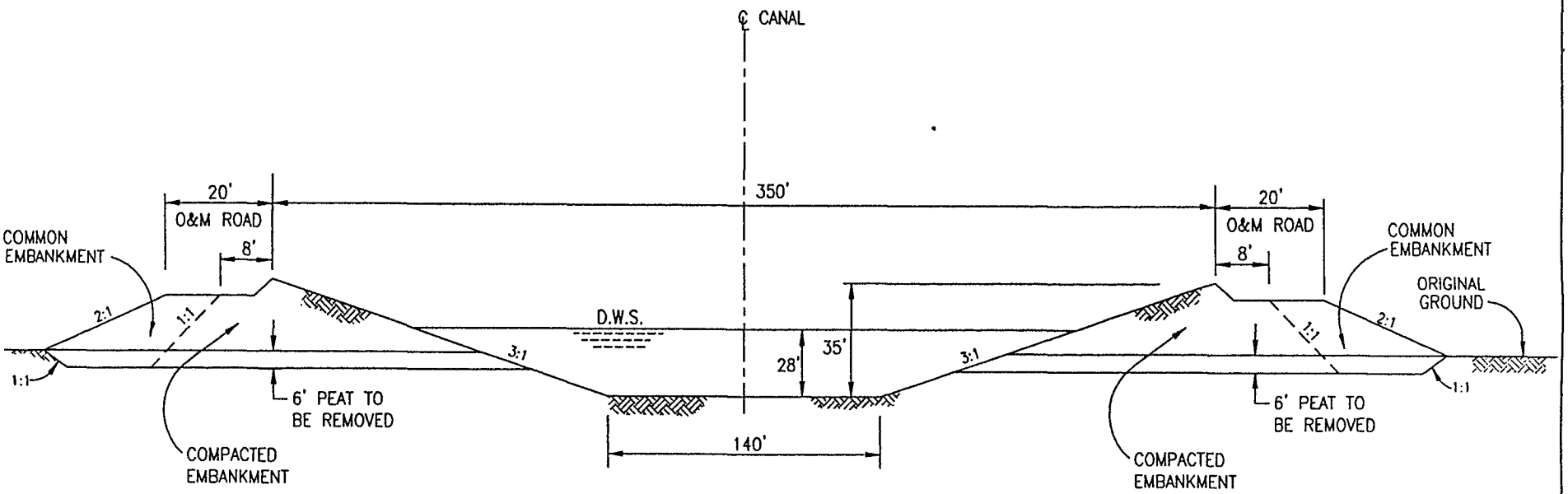

TYPICAL CANAL SECTION

EASTERN ISOLATED SOUTH DELTA INTAKE

NOT TO SCALE

Figure 5

Typical Canal Section–Eastern Intake

Multiple Intakes Option

CALFED BAY-DELTA

D-005248

D—005248